IN THE SPECIFICATION:

Please amend the specification as follows.

Please amend the first full paragraph on Page 80, beginning on line 19 and ending on Page 81, line 12 to read as follows:

The output characteristics of the O_2 sensor 8 change depending on the temperature of the active element 10 thereof. In FIG. 3, the solid-line curve "a", a broken-line curve "b", a dot-and-dash-line curve [["b"]] "c", and a two-dot-and-dash-line curve "d" represent the output characteristics of the O_2 sensor 8 when the active element 10 has temperatures of 800°C, 750°C, 700°C, and 600°C, respectively. As can be seen from FIG. 3, if the temperature of the active element 10 changes in a temperature range lower than 750°C, then the gradient (sensitivity) of a change in the output Vout of the O_2 sensor 8 in the vicinity of the stoichiometric air-fuel ratio (the high-sensitivity air-fuel ratio range Δ) and the level of the output Vout at air-fuel ratios richer than the high-sensitivity air-fuel ratio range Δ tend to change. If the temperature of the active element 10 is 750°C or higher, then a change in the output characteristics of the O_2 sensor 8 with respect to a change in the temperature of the active element 10 is so small that the output characteristics of the O_2 sensor 8 are substantially constant.

Please amend the third full paragraph on Page 111, beginning on line 15 and ending on Page 112 to read as follows:

If a state quantity vector X0(k) = (e(k),Δe(k),

$\Delta Tht(k))^T$ (T represents a transposition) is introduced, then the following equation (15) is obtained from the equations ~~(14), (15)~~ (13), (14) and the equation $e(k+1) = e(k)+\Delta e(k)$:

$$X0(k+1) = \Phi \cdot X0(k)+G \cdot \Delta SDUT(k)+Gd \cdot \Delta Tgd(k)+Gr \cdot R0(k+1) \quad \cdots(15)$$

where $X0(k) = (e(k),\Delta e(k),\Delta Tht(k))^T$,

$R0(k+1) = (\Delta R(k+1),\Delta R(k))^T$,

$G = (0,0,Dx \cdot dt)^T$,

$Gd = (0,Ax \cdot dt,0)^T$,

$$\Phi = \begin{bmatrix} 1 & 1 & 0 \\ 0 & 1-Ax \cdot dt-Bx \cdot dt-Ex \cdot dt & Bx \cdot dt \\ 0 & Cx \cdot dt & 1-Cx \cdot dt-Fx \cdot dt \end{bmatrix}$$

$$Gr = \begin{bmatrix} 0 & 0 \\ -1 & 1-Ax \cdot dt-Bx \cdot dt-Ex \cdot dt \\ 0 & Cx \cdot dt \end{bmatrix}$$

Please amend the first full paragraph on Page 126, beginning on line 3 to read as follows:

If COPC = 0, then the sensor temperature control means 18 newly sets the value of the countdown timer COPC to a timer setting time TM1 which corresponds to the period dtc of the control processes of the target value setting means 21 and the heater controller 22 in STEP3. Thereafter, the target value setting means 21 carries out a process of setting a target value R for the element temperature T_{O2} of the O_2 sensor 8 in STEP4, and the heater controller 22 carries out a process of calculating a duty cycle DUT of the heater 13 in STEP5. If COPC $\neq$ 0 in STEP2, then the sensor temperature control means

18 counts down the value of the countdown timer COPC in ~~STEP5~~ STEP6, and skips the processing in STEP4 and STEP5. Therefore, the processing in STEP4 and STEP5 is carried out at the period dtc determined by the timer setting time TM1.

Please amend the second full paragraph on Page 162, beginning on line 18, and ending on Page 163, line 10 to read as follows:

In the present embodiment, the weighted matrixes Q0, H0 with respect to the evaluating function J2, the target value predicting time Mr, and the exhaust gas temperature predicting time Md are identical to those in the first embodiment. However, they may be set to values different from those in the first embodiment. The coefficients Fs2, Fx2, Fx3, Fr2(i), Fdt2 in the equation (36) may not necessarily be of the values according to the defining equations (37-1) through ~~(237-3)~~ (37-3), but may be of values adjusted by way of simulation or experimentation. Furthermore, the coefficients Fs2, Fx2, Fx3, Fr2(i), Fdt2 may be changed depending on the element temperature, the heater temperature, etc. In the present embodiment, as with the first embodiment, the exhaust gas temperature Tgd is maintained at the present value in the future until after Md steps. However, if Tgd at each time in the future can be detected or estimated, then the control input DUT may be determined using those values (in this case, Fdt2 is a vector).